## Report on Asker, Mangerton and Lower Brit Riverfly monitoring in 2022

This report considers riverfly monitoring at the following locations on the Asker: 1) above Askerswell village, 2) by Folly farm, 3) Butterwells, Uploders, 4) Loders below its weir and 5) by the Co-op, Bridport. In addition, it covers sites at Milton mill on the Mangerton River and Plottingham on the river Brit in Bridport.

### 1: Anglers' Riverfly Monitoring Initiative (ARMI) based on the abundance of eight invertebrates

Locations were subject to riverfly monitoring for eight invertebrates at monthly intervals from April to September in 2022. The data showed both site and seasonal changes in the proportion contribution of each invertebrate to the total number of individuals recorded for each month (Figure 1). The data was restricted to 2022 as it varied with year when all results collected to-date were included.

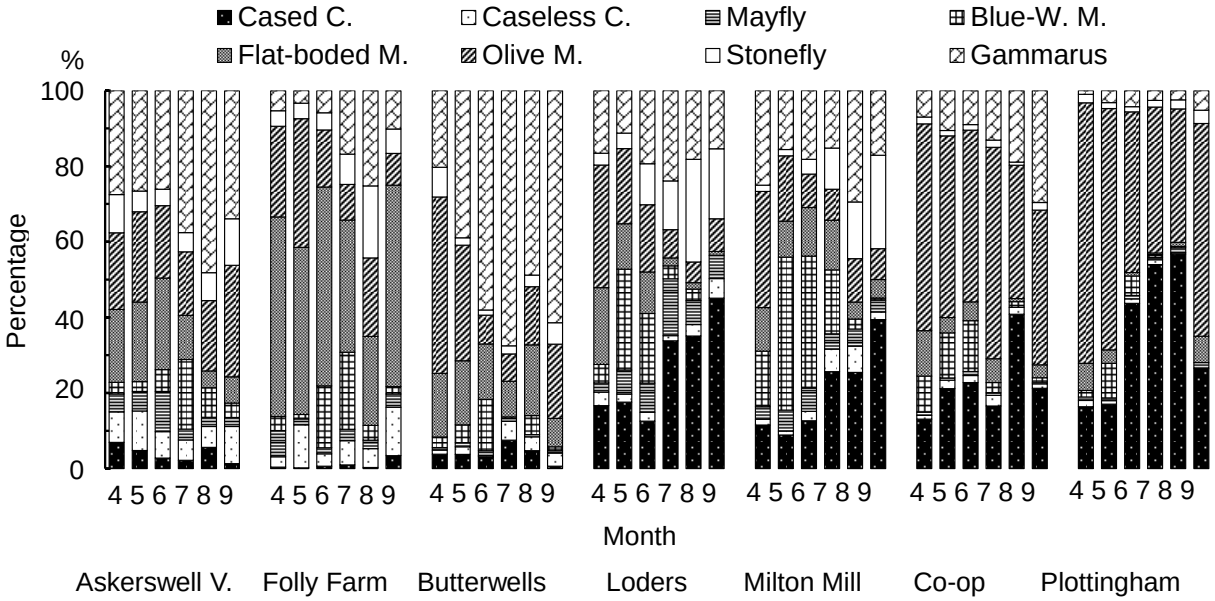


**Figure 1**: The percentage contribution of each of the eight recorded invertebrates from April to September based on seven monitoring locations in 2022.

The proportion of each of the group differed significantly by site for all ($P<0.05$, Bonferroni test, Univariate ANOVA [analysis of variance]) except blue-winged olive mayfly. Similar analysis indicated significant changes with month for all but caseless caddisfly. The proportion of an invertebrate present each month was expressed as proportion of the month with the maximum value at that site. The results are shown for flat-bodied and blue-winged mayflies in Figure 2. A curve was fitted to each data set using a 3rd polynomial and maximum abundance was estimated from the regression equation. This was at 19th April and 9th May 2022 for flat-bodied and blue-winged olive mayflies respectively.

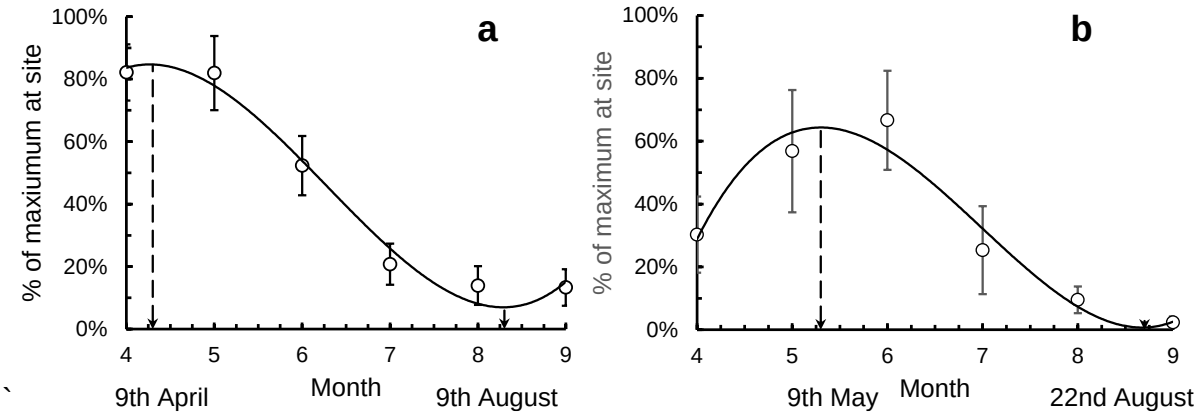


**Figure 2:** Flat-bodied mayflies (a) and blue-winged olive mayflies (b) showed well defined seasonal changes in abundance. The grand means (± SEM) are based on all seven sites. The maximum and minimum presence for all seven sites are predicted by a third polynomial curve.

Members of the group of eight were not found in equal abundance at all sites. Cluster analysis was used to identify those whose abundance followed a similar pattern. The analysis suggests three clusters: 1) mayfly with blue-winged olives 2) caseless caddis, flat-bodied mayfly, *Gammarus* and stoneflies and 3) cased caddis with olive mayflies. The clusters are likely to be influenced by seasonal effects such the timing of emergence for the adult insects and other factors such as substrate and flow rate. The clustering is similar to that in 2021 except in that year flat-bodied mayfly and *Gammarus* clustered with mayfly and blue-winged mayfly.

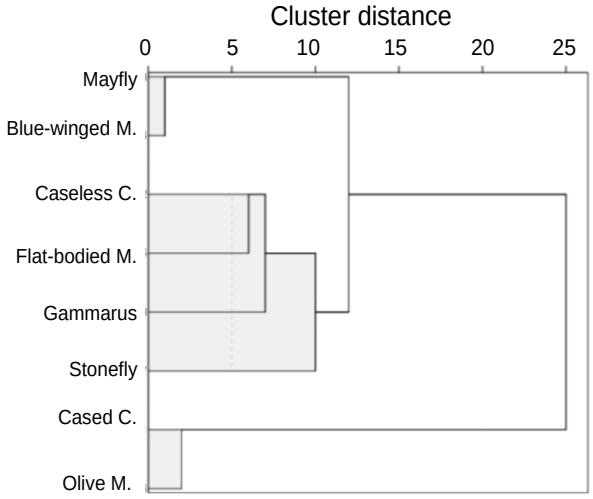


**Figure 3:** Cluster analysis for the eight invertebrates for the data collected in 2022 for the seven monitoring sites indicated three clusters.

Differences also emerge for cluster analysis based on the locations. There are three clusters comprising 1) Co-op and Plottingham, 2) Askerswell village and Butterwells, 3) Loders weir and Milton mill and Folly farm (Figure 4). This is a similar pattern to reported in 2021 except Folly Farm clustered with Askerswell village and Butterwells in 2021.


**Figure 4:** Cluster analysis for the seven monitoring sites indicating the extent to which sites were similar in their abundance of individuals of the eight recorded invertebrates for all collection months in 2022.

There were significant differences by year as well as site and month. Five sites provided their highest reading in 2021 and one each in 2019 and 2022. There is no evidence that the low rainfall in the summer of 2022 had a substantial effect on the scores for the group of eight.

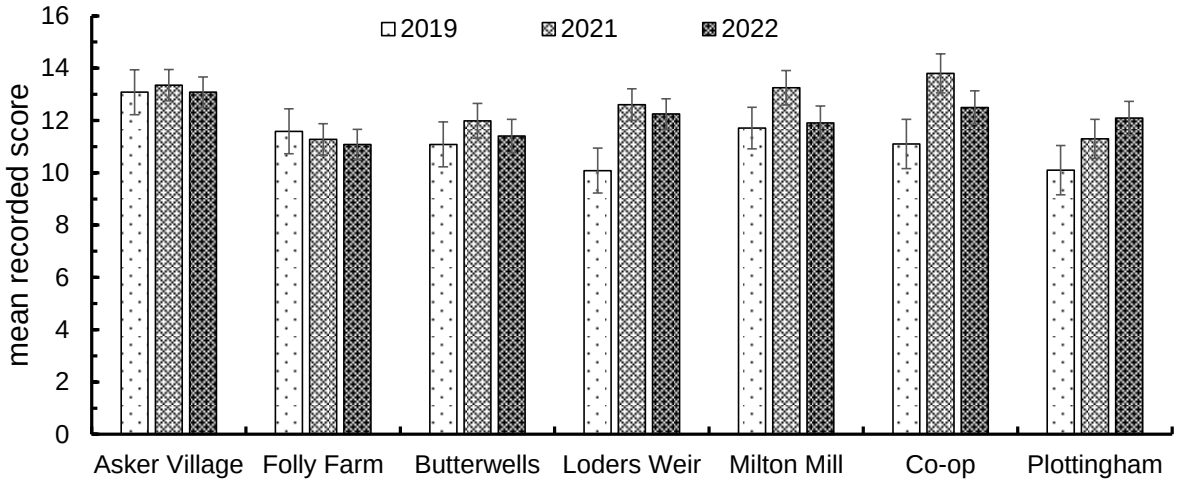


**Figure 5:** The adjusted mean recorded scores for the seven sites estimated in late June for three years based in Univariate ANOVA

The variation in the mean recorded scores by month was taken account of by univariate analysis. The value for each site was estimated in June and varied from 11 to 14 (mean 12.7 ± 0.52) in 2019, from 11 to 15 (mean 13.2 ± 0.75) in 2021 and 11 to 14 (mean 13.2 ± 0.59) in 2022 (Figure 5). The recorded mean score in June 2022 represents a relatively high score within the ARMI national site for values recorded in June 2022. Only 15% of sites recorded nationally had a higher score than 13 (Figure 6). The limitation on such comparisons is that the AMRI group of eight is influenced

by the total number of invertebrates recorded. This depends on collection effort which may be more or less than two person hours / sampling occasion.

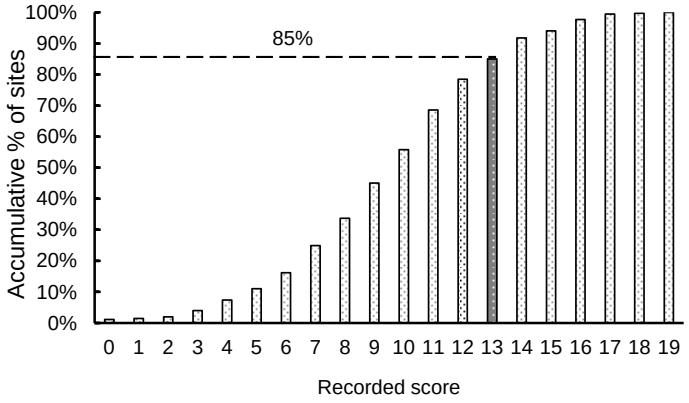


**Figure 6:** Accumulative percentage of scores in June 2022 for all sites in the national ARMI data base.

## 2: Analysis based on extended riverfly scores

This system differs from the group of eight. It provides scores for 33 different invertebrates including the original eight. It also has positive or negative weights of the score for the different invertebrates depending on their tolerance to low water quality. Consequently, the score may be lower or higher than obtained with the group of eight. The extended scoring system recorded most invertebrates collected during sampling and so it increases the range of analyses possible.

**Some estimates used in ecological studies:** The Shannon index increases as both the range of different organisms increases in a community and the similarity in the number present of each. A value of 0 would occur if only one species was recorded. Typical values are generally between 1.5 and 3. Its values for the 2022 extended riverfly groups did not change significantly with sample month in contrast to 2021. The values differ between sites (Table 1) but the values are similar to those recorded for the first four sites in Table 1 which were also sampled in 2021. This suggests that the community remained stable between the two years.

**Table 1.** Shannon index values for sites at which the extended riverfly data was collected in 2022. Values are means ± SEM with a different suffix indicating significant sub-groups ($P<0.05$, Oneway ANOVA).

| Site | Mean |
|---|---|
| Askerswell v. | $2.21 \pm 0.078^{a,b}$ |
| Folly farm | $1.96 \pm 0.065^{b,c}$ |
| Loders | $2.29 \pm 0.088^{a}$ |
| Milton mill | $2.08 \pm 0.094^{a,b,c}$ |
| Co-op | $1.86 \pm 0.071^{c}$ |
| Plottingham | $1.87 \pm 0.088^{c}$ |

Simpson's index is another widely used approach to characterise a community's diversity. It increases from 0 to a maximum of 1 as the number of different organisms

present increases also taking into account the number of each present. Simpson's index changes significantly with month and values are estimated at the start of July by Univariate ANOVA (Table 2). The values for Askerswell village and Loders were significantly greater than those for Co-op and Plottingham sites ($P < 0.05$, Bonferroni test, Univariate ANOVA). The values for the four sites evaluated in 2021 (Askerswell village, Folly farm, Loders and Milton mill) were in the same rank order as in 2021 with similar means. Again, this suggests stability in the community for 2021 and 2022.

**Table 2:** Simpson's index values for sites at which the extended riverfly data was collected in 2022. Values are means ± SEM.

| Site | Mean |
|---|---|
| Askerswell v. | 0.977 ± 0.009 |
| Folly farm | 0.963 ± 0.009 |
| Loders | 0.979 ± 0.009 |
| Milton mill | 0.964 ± 0.009 |
| Co-op | 0.934 ± 0.009 |
| Plottingham | 0.926 ± 0.009 |

**Species at risk (SPEAR)**: this index used by the Environment Agency to record water quality from a measure of species at risk (SPEAR) from pollution. Data was collected for many years at Yondover, Loders by the Agency. These values and those obtained from the group of 33 by some monitors are given in Figure 7. Site may influence values which are mainly lower for Yondover than for the other data. However, both curves suggest a clear trend in values for SPEAR from moderate to good and now high water quality for invertebrates at the sites currently being monitored.

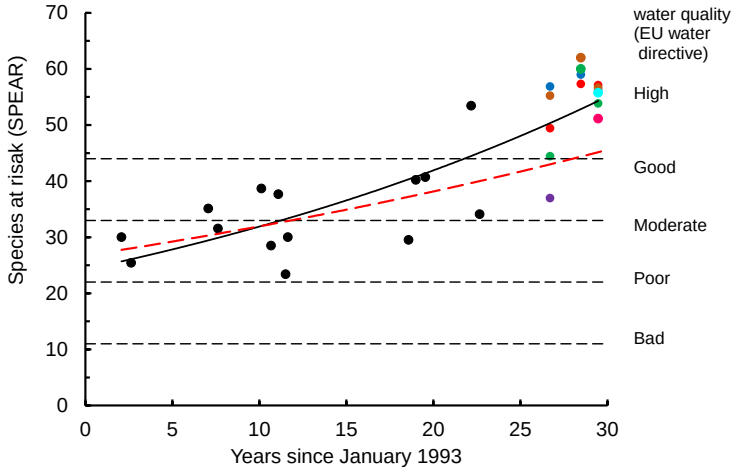


**Figure 7**: The relationship between the index of species at risk (SPEAR) from pollution and lapsed years since data was first collected in 1993. Data from The Environment Agency for Yondover, Loders (●) and collected in 2019, 2021 and 2022 for sites at Askerswell village: (●); Folly Farm (●);Loders below the weir (●); Milton Mill (●), Loders Mill race (●) Co-op (●) and Pottingham (●). Exponential curves are fitted to the Yondover data ($R^2 = 0.34$) extrapolated to 2022 and to all the data ($R^2 = 0.73$). Both curves are statistically significant ($P < 0.05$).

**Lotic Invertebrate Flow Evaluation (LIFE):** Invertebrates vary with different stream flow rates that favour their abundance. Each of the extended groups has a flow group value that weights their log scale abundance based on the same scoring system as used for the group of eight. To set the context, flat-bodied mayflies and caseless caddis are associated with high flow rates of typically more than 100cm/second. The remaining six of the groups of eight are associated with the next flow rate down of 20-100cm/second. Some other members of the extended group fit into a third group associated with slow flowing and standing waters such as dragonfly nymphs.

The accumulated score (one value per group) is divided by the number of groups. A LIFE score of less than 6.00 generally indicates sluggish or still water conditions. The value increases with higher flow rates with values greater than 7.5 indicating a very fast flow.

The values for the LIFE index varied significantly with month in 2022 ($P < 0.01$ Bonferroni test, Univariate ANOVA) and so values are estimated for the end of June. Folly farm site had the highest LIFE value and significantly greater values than the similar ones for above Askerswell village, Milton mill and Plottingham (Table 1). The Folly farm site is on riffles in a short section with an appreciable gradient. Its value suggests a higher flow rate than at the other three sites. The mean LIFE value for three similar sites of about 7.7 suggests fast flowing characterises both for the Asker and Mangerton rivers. The Environment Agency has recorded the LIFE value at Yondover, Loders with a gradual increase from c7 in the mid-1980s to c7.5 in 2014. The continual increase with time in the LIFE value may arise from factors such as reducing pollution (as measured by SPEAR) rather than an increase in river flow rates.

**Table 3**: LIFE and PSI values for 2022 are means ± SEM with similar values sharing the same suffix ($P<0.05$, LIFE comparisons based on Bonferroni test, Univariate ANOVA) for estimates at the end of June. The values for PSI are compared by SNK, Oneway ANOVA as values at a site did not differ with the sample month.

| Site | LIFE | PSI |
|---|---|---|
| Askerswell v. | $7.73 \pm 0.096^{a}$ | $63.4 \pm 2.0^{c,d}$ |
| Folly farm | $8.17 \pm 0.096^{b}$ | $73.7 \pm 2.9^{d}$ |
| Loders | $7.81 \pm 0.0.096^{a,b}$ | $67.7 \pm 3.0^{d}$ |
| Milton mill | $7.66 \pm 0.096^{a}$ | $56.0 \pm 2.5^{c}$ |
| Co-op | $8.02 \pm 0.096^{a,b}$ | $73.5 \pm 3.7^{d}$ |
| Plottingham | $7.69 \pm 0.096^{a}$ | $63.4 \pm 2.0^{c,d}$ |

**Proportion of sediment-sensitive invertebrates (PSI index):** This is calculated similarly to the LIFE index but different weightings are allocated to four groups depending on their sensitivity to sediment. There are five categories on a scale of 0-100 ranging from heavily sedimented (0-20) to minimally sedimented (80-100). There was not a significant change with month. The values for five sites indicate a slightly sedimented river-bed with Milton mill being at the upper end of the moderately sedimented range. The overall value for all four sites were similar in 2021 and 2022 ($66.8 \pm 1.41$ and $65.20 \pm 1.82$ respectively) and to values obtained by the Environment Agency in 2012 and 2014.The sedimentation level (PSI) and flow rates (LIFE) are correlated ($R^2 = 0.60$; $P<0.001$) as expected.

**Water chemistry**

The Asker has a stable water chemistry. The river at both Askerswell village and Folly farm have a constant alkaline pH of c8.4 whereas that at Loder and Milton mill are 0.1 to 0.3 units more alkaline. The conductivity and phosphate levels also do not change much between years (Table 2). The water at the four sites assessed were moderately hard, or bordering on that range, (500-640µS/cm). All sites had phosphate levels within the revised system of moderate level (second highest of four categories: UKTAG Final report 2013). They are in the expected range for a chalk river of 100-300µg/L (*https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf*). This suggests the phosphate levels recorded are not related to activities such as agriculture. The river can be considered therefore as a stable aquatic environment, free of pollution concerns for its invertebrates which probably underpins its high ARMI scores.

**Table 2**: Mean conductivity and phosphate in the Asker and Mangerton rivers in 2019, 2021 and 2022.

| Site | 2019 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|
| | Conductivity | Phosphate | Conductivity | Phosphate | Conductivity | Phosphate |
| | µS/cm | µg/L | µS/cm | µg/L | µS/cm | µg/L |
| Ask. vill. | 553 ± 10.5 | 109 ± 30.4 | 493± 6.4 | 150 ± 12 | 491 ± 15.1 | 209± 33.0 |
| Folly farm | 591 ± 10.5 | 115 ± 10.5 | 501 ± 15.2 | 193 ± 32.4 | 499 ± 12.0 | 200 ± 36.5 |
| Loders | | | 537 ± 11.1 | 120 ± 12.2 | 591 ± 13.0 | 146 ± 12.5 |
| Milton mill | | | 617 ± 77 | 150 ± 32 | 560 ± 8.6 | 190 ± 40.0 |

## 3: Classification of the Asker and Mangerton rivers

Chalk streams in the UK have been subdivided into four types (A-D) in 2021. The Asker is classified as an example of a Group C: scarp-face chalk streams. The Mangerton has not been included in this national classification. Group C: scarp-face chalk streams rise at the base of the chalk and tend to run for a short distance over older (clay rich) chalk and then flow out onto the underlying gault clay and greensand beds (*https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf*). The Asker is considered moderately sensitive to water abstraction (middle of 3 categories) supporting a good flow. It is categorised as good for its low phosphorus levels (second best in five categories (*https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-APPENDICES-FINAL-12.10.21-Low-Res.pdf.)*

The Asker normally has a low turbidity of <12 nephelometric turbidity units (NTU) but a slightly higher value was reported of 15 NTU in June 2022 at the Folly farm site repeating its slightly higher NTU in early July and August 2021. The hydrology of type 2 rivers is dominated by the subdued hydrological response to rainfall. The alkaline pH of around 8.4 with buffering from the dissolved salts is apparently sufficient to prevent rainwater from lowering its value. That water chemistry may occur after heavy rainfall but that is unlikely to be detected by monthly monitoring.

The river also has an invertebrate community expected of a river of this type (see 2021 Report). Fish typical of the type of rivers to which the Asker and Mangerton belong include those listed from a survey conducted by Casterbridge Fisheries in October 2021 in Table 3. Others not recorded during survey that often occur in rivers of this

type are grayling and brook lamprey. The latter has been observed previously in the Asker. The absence of migratory salmon and/or sea trout may relate to obstructions such as Loders weir although eels that can also be prevented from migration were recorded at Boarsbarrow.

**Table 3**: Fish Population Survey Report for the River Asker, October 2021.

| Site | Trout* fish/$m^2$ | Eel* | Stone loach* | Bullhead* | Minnow | Signal crayfish |
|---|---|---|---|---|---|---|
| Boars barrow | 0.12 | A | B | B | B | NT |
| Well plot | 0.08 | NT | B | B | A | NT |
| Folly farm | 0.1 | NT | A | B | NT | present |

A (1-9), B, (10-99) i.e. the log scoring system also used for ARMI riverfly monitoring. NT is not detected. *, typical fish of river of the type to which the Asker belongs.

The survey reported about 0.1 trout/$m^2$ which is about 20x greater than in a previous survey by Casterbridge Fisheries in 2012 at Stepps Farm, downstream of Boarsbarrow close to the confluence of the Asker with the Mangerton. Figures for the Piddle around Tolpuddle were recorded in 2000 (Burrows, 2006; *http://eprints.mdx.ac.uk*) were 2-3x the 2021 values for the Asker. Trout density depends on suitable habitat which varies for different life stages. Many factors contribute to suitability including river depth, width, flow rate, the substrate, river plants and tree cover. The Asker lacks many plants such as *Ranunculus* (water crowfoot) that favour fish populations. This is probably due to the tree cover shading the river. This is exacerbated by the river's narrow width allowing trees to shade much of the river's width. Tree roots in the water adjacent to the riverbank provide habitat for the trout.

Possibly chalk rivers may support different group of eight scores than other river types. This was investigated using scores for the group of eight invertebrates for chalk rivers in the ARMI data set in 2022. Values considered were for the Avon (Hampshire), the Test and Itchen (Wiltshire and Hampshire), the Wensum (Norfolk) and the Asker, Mangerton and Cerne (Dorset). Values vary with the sample date as a covariate ($P = 0.001$, Bonferroni test, Univariate ANOVA). Estimates are provided in Table 4 after adjusting for date. This analysis provides another indication of the Asker and Mangerton's high river water quality for invertebrates when compared with other chalk rivers.

**Table 4**: Means (± SEM) from April-October 2022 for Group of eight invertebrates recorded for chalk rivers in the ARMI data set.

| Test & Itchen | Asker | Mangerton | Wensum | Cerne | Avon |
|---|---|---|---|---|---|
| 12.6 ± 0.38 | 12.0 ± 0.38 | 11.9 ± 0.93 | 11.6 ± 0.78 | 10.5 ± 1.04 | 9.1 ± 0.46 |

The means for the Asker and Test & Itchen are greater than that for the Avon ($P<0.001$, Bonferroni test, Univariate ANOVA). Scores are estimated for 29th June.

## 4: Birds and mammals associated with the Asker.

The DAONB 60th anniversary fund awarded a grant of three trail cameras in mid-2020 to support identification of the locale and breeding status of mammals and birds known from the river. The cameras have been placed, but not always continuously, for 28 months at sites in Askerswell parish, Uploders and Loders. An additional camera has been operating at Milton mill. The species of wild birds (42) and mammals (13)

recorded to date are listed in Table 5 indicating locations in 2022 and species recorded for the first time for that reporting year. The list includes few species observed but not imaged by the trail cameras. The key additions this year are mink, water vole, water shrew and dipper. Mink were recorded on the trail camara at Milton Mill but also seen at Loders and probably Askerswell. West Dorset is at the eastern end of the dipper's breeding range in SW England (*BTO Bird Atlas Mapstore*, Breeding distribution 2008-11), It has been recorded breeding before in the Mangerton and Asker Rivers (1987-1994 surveys, *The Birds of Dorset*, G. Green).

A distinction can be made between animals that are 1) more or less riverine (e.g. kingfisher, dipper, water shrew, water vole, otter and mink), 2) those that visit the river as well other locations to feed (e.g. swallow, house martin), 3) to drink or wash (e.g. buzzard, tawny owl), 4) local animals merely crossing the river when recorded (e.g. deer, and badger) and 5) others merely passing through the location (e.g. peregrine falcon and cuckoo).

**Table 5:** List of birds and mammals imaged by the trail cameras or seen.

| | |
|---|---|
| Birds | Buzzard$^{ALM}$, Peregrine$^{L}$, Hobby$^{L}$, Kestrel$^{L}$, Red Kite$^{L}$, Sparrowhawk$^{M}$, Tawny Owl$^{LM}$,Barn Owl$^{L}$ Pheasant$^{AULM}$, Woodpigeon$^{AULM}$, Collared Dove, Heron$^{ULM}$, Little Egret$^{LM}$, Gulls$^{L,}$ Moorhen$^{LM}$, Dipper$^{LM}$,G.S Woodpecker$^{LM}$, Green Woodpecker$^{LM}$, Wren, Bluetit, Grey Wagtail$^{LM}$, Blackcap, Crow$^{AUL}$, Rook$^{UM}$, Jay$^{U}$, Jackdaw$^{U}$, Magpie$^{AL}$, Raven$^{L}$, Kingfisher$^{LM}$, Mallard$^{LM}$, Cuckoo$^{L}$, Skylark$^{L}$, Yellowhammer$^{L}$, Blackbird$^{UM}$, Redwing$^{M}$, Robin$^{M}$, Swift$^{L}$, Swallow$^{L}$, H. Martin$^{L}$, Goldcrest$^{L}$ Chaffinch$^{M}$, Long-tailed tit$^{L}$, and chickens |
| Mammals | Hedgehog$^{L}$, G. Squirrel$^{LM}$, Rabbit$^{AUL}$, Roe$^{AULM}$, Fallow$^{AL}$, Fox$^{AULM}$, Badger$^{AM}$, Otter$^{ULM}$, Mink$^{M}$, Brown Rat$^{AULM}$, Mouse (field?)$^{AU}$, Water Shrew$^{L}$, Water Vole$^{B}$, Dog, Cat$^{A}$, Sheep$^{A}$ Human. |

The list is those reported in 2021 with additional species detected for the first time in 2022 underlined. Suffixes indicate records for 2022: $^{A}$Askerswell parish; $^{U}$Uploders (Butterwells); $^{L}$Loders; $^{M}$Mangerton (Milton mill) and $^{B}$ Bridport (Co-op).

## 5: Bats

A bat has been detected rarely by the trail cameras. Often, they are likely to fly above the detection range of the camera. In addition, their small size and rapid movement may not always trigger the night-time detection system when flying just above the river. Bat detectors have been used in both Askerswell and Loders. The considerable range of bats detected particularly around Askerswell village were reported in the report for 2021. Only a subset of these species such as Daubenton's bat are specifically associated with aquatic environments.

## 6: Future Work

1. To continue monitoring at the existing sites in 2023
2. To acquire and utilise mink monitoring rafts during the riverfly collection season in 2023 to determine if this predator prevents colonisation of much of the Asker and Mangerton by water voles.
3. To support efforts to install a fish bypass for Loders weir to enhance colonisation of the river as by the European Eel. It is among the rarest and most threatened animals in the UK and critically endangered on the IUCN Red List. Improved access will also provide opportunities for sea trout and salmon already entering the lower reaches of the Asker to reach spawning grounds. *HJA 23/11/2022*